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Report on the 2nd International Summer School on Network and Service Management (ISSNSM'08)

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Abstract This report summarizes the 2nd International Summer School on Network and Service Management (ISSNSM'08), which was held at the Communication Systems Group (CSG) of the Department of Informatics (IFI), University of Zurich, Switzerland, on 2–6 June 2008. Supported by the European FP6 Network of Excellence for the Management of Internet Technologies and Complex Services (EMANICS), the ISSNSM presented within 5 days eight different topics, covering the areas of (1) security, (2) virtualization and simulations, and (3) network monitoring and management. All of these run for a full or half day, including a short theoretical introduction and larger practical lab course components, respectively.

Keywords Network management · Service management · Security · Virtualization · Network monitoring

1 Introduction

The 2nd International Summer School on Network and Service Management (ISSNSM'08) was held at the University of Zurich, Switzerland, on June 2–6, 2008 [1]. The full technical and local organization had been performed by the Communication Systems Group (CSG) of the Department of Informatics (IFI) at the University of Zurich, which was supported technically and financially by the European FP6 Network of Excellence for the Management of Internet Technologies and Complex Services (EMANICS) [2]. This short report summarizes the concepts and ideas, which have been applied and refined to organize a summer school, which

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shows the most suitable benefit for students and interested researchers in a field of highly interrelated theoretical *and* practical aspects. Additionally, this report summarizes the technical program and it draws conclusions, while addressing feedbacks received from participants and experiences made from an organizer's point of view. The 3rd ISSNSM is already planned for 2009 and potentially interested people will be welcome to check for details, following the new links to be established originating from [2].

2 Concept and Approach

While summer schools have found a quite significant position in teaching and education, especially addressed to students and researchers, who are interested to get attached to a new field of expertise in a short period of time, their content and organizational approach varies highly. Therefore, EMANICS determined that the need to educate Ph.D. students in the area of network and service management across affiliation and country borders. The 1st ISSNSM had been hosted by the Jacobs University Bremen, Germany and it enabled students to interact closely on a certain topic during presentations and discussions. To continue in that direction, the 2nd ISSNSM extended the practical parts of the summer school in that respect that about one third of the time, typical classroom teaching took place and in the other two thirds of the time practical lab courses had been organized and run, which addressed the respective topic's key aspects.

The understanding of theoretical concepts *and* practical approaches, tools, and systems has proven to be a highly successful summer school concept, since those prepared lab courses and experiments deepened the knowledge of the topic extremely well. The work in practice—fully supervised by the respective instructor(s)—included the application of knowledge, which typically a pure one-way lecture or a book reading will not provide. Therefore, the group of eight topics, presented by academic and industrial instructors, followed this scheme.

3 Program and Topics

The 5-day summer school had selected eight topics out of a number of proposals collected from within the EMANICS community and beyond. Those eight topics covered the areas of (1) security, (2) virtualization and simulations, and (3) network monitoring and management. While instructors have been active in the development of tools themselves, all of them prepared the practical lab course components and made them applicable to a full or half day course. While general questions of the audience have been posed and answered during the respective presentations, many discussions between the exercise groups of two people and the instructor took place in the lab sessions and continued during the breaks and early evenings. All teaching material is available at [1].

3.1 Security

The objective of the course "Hacking Web2" given by Radu State was to give a hands-on experience to web server security assessment. It provided the necessary background material to learn how web servers are exploited by blackhats. The course covered web server reconnaissance, application level vulnerabilities, web client level abuse, and phishing methods. Since web traffic is typically allowed by most firewalls, more than 80% of the current intrusions are caused by misconfigured or vulnerable web applications. Therefore, providing adequate security solutions for web applications and servers determines an essential building block for an overall enterprise level security architecture.

3.2 Virtualization and Simulations

The Network Simulator 2 (ns-2) is an open source simulator for different kinds of networks [3]. Because of its open and extendable nature a number of devices, protocols, and applications are already implemented. This course on "Simulating Networks with Network Simulator 2" by Frank Eyermann gives a basic insight into working with ns-2. Based on the structure of ns-2 shown, the lab courses runs less complex examples, which are performed and analyzed. A special focus is put on monitoring of queues and queuing disciplines, routing protocols, and stochastic elements.

The course on "Using Xen Virtualization in Research Projects" by Kyrre Begnum was targeted at researchers who want to utilize virtualization for their experiments and test labs. Xen is a popular open source virtualization technology used widely in the industry today [4]. It provides good performance even with many virtual machines running on the same hardware. Its ease of specialization makes Xen suitable for repeatable scenarios, where virtual machines are set up in specialized configurations and network topologies. Getting practical experience and to learn how to design and set up virtual machines was extended by virtual machine management, which was covered as well as performance tuning and troubleshooting issues.

The work on "Distributed Test-Lab: EMANICSLab" presented by Cristian Morariu and David Hausheer introduced the basic concepts of virtual distributed test-labs like PlanetLab or EMANICSLab and gave a hands-on training about how to use them for research activities. Based on the underlying idea and principles of PlanetLab an overview of its services and tools was given. At a detailed level the EMANICSLab [5], a smaller-scale test-lab was explained and tested. In particular, the monitoring and management capabilities of EMANICSLab have been experienced, which has been carried out based on a simple service deployed on EMANICSLab.

3.3 Network Monitoring and Management

The goal of the course termed "Do you know SNMP?" by Aiko Pras was to make attendees aware of common mistakes made in SNMP (Simple Network

Management Protocol) related papers. Driven by a short introductory exam to identify what attendees already know/learned from other courses, four lab sessions did refine the knowledge in the definition of a new MIB (Management Information Base) module, in finding right MIB data, on using SNMP, and on ASN.1 (Abstract Syntax Notation) decoding. These lab sessions applied MIB validating tools, real MIB data, and an SNMP agent simulator.

The course on "Nagios" by Laurent Andrey and Remi Badonnel outlined the open source software product for monitoring hosts, networks, and services [6]. Widely deployed by network administrators in companies and organizations, this tool provides an easy and extensible way of checking the operational status of network elements, and detecting a large variety of failures in real time, such as host resource overload and network service breakdown. Practical aspects showed how Nagios determines status information about hosts and services using periodic checks, information exchanges by advanced notification schemes, and the implementation and execution of checks.

The "Introduction to NETCONF and YANG" by Jürgen Schönwälder discussed the NETCONF protocol (RFC 4741, RFC 4742) [7] and the YANG data modeling language [8]. The NETCONF protocol provides mechanisms to install, manipulate, and delete the configuration of network devices. The protocol uses a Remote Procedure Call (RPC) paradigm and allows new protocol operations to be added. YANG is a proposed data modeling language for NETCONF, which has recently been selected as the basis of an IETF standardization effort. Based on fundamental concepts of NETCONF and YANG attendees gained practical experience by interacting with NETCONF implementations, while using YANG tools to validate self-written data models.

Finally, the course "Managing Information from your Network" by Bruno Klauser addressed a number of important network management questions: On what network and traffic data does your planning and engineering rely? Can you validate your design assumptions? Does your network meet the expectations and requirements implied by business critical services? If so: can you prove it? Due to today's network elements plethora of device manageability instrumentation capabilities suitable answers have been given by the discussion of technology fundamentals as well as the use of appropriate practices through a combination of presentation and hands-on exercises.

4 Experiences and Next Steps

This summer school was attended by 31 persons from 11 different countries, which originated from 16 different affiliations. Furthermore, 7 persons attending did not belong to the EMANICS consortium, thus, showing that the interest in network and service management runs well beyond the NoE's limits. Attendees also came from industry and senior researchers completed the group of Ph.D. students.

The evaluation form handed out to all participants covered questions on the local organization, infrastructure, and interaction times with instructors as well as on the technical program, the instructors in general and detail, and on the lab sessions as

such. On a five digit scale (1 being the best and 5 being the worst) and based on 18 feedback forms received, on average the local organization was rated at 1.2, the infrastructure at 1.1, and the interaction possibilities at 1.3. The selection of topics for the overall program was rated at 1.6, the overall instructor's quality at 1.8, and the quality and usefulness of lab sessions at 1.9. All participants had a very good and successful time, in which new topics have been learned, practical experiences have been gained, and last but not least new friendships have been formed!

Due to this great success and motivating comments received, the summer school for 2009 is in planning and will continue as the 3rd event the concept of ISSNSM.

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Author Biographies

Dr. Burkhard Stiller chairs the Communication Systems Group CSG, Department of Informatics IFI at the University of Zürich UZH since 2004. He holds a Computer Science Diploma and a Ph.D. degree of the University of Karlsruhe, Germany. During his research locations of the Computer Laboratory, University of Cambridge, U.K., the Computer Engineering and Networks Laboratory, ETH Zürich, Switzerland, and the University of Federal Armed Forces, Munich, Germany his main research interests cover, including current CSG topics, charging and accounting of Internet services, economic management, systems with a fully decentralized control (P2P), telecommunication economics, and biometric management systems.

Dr. David Hausheer is a senior researcher and lecturer in the Department of Informatics IFI at the University of Zürich UZH, focusing on economic management of Grid and P2P networks and services. He holds a diploma in Electrical Engineering and Ph.D. in Communication Systems from ETH Zürich, Switzerland.